Amendments to the Claims

What is claimed is:

1. (**Currently Amended**) A method for reconstructing a bioluminescent source distribution within an object, comprising:

imaging the object using a tomographic imaging device to produce a first reconstructed image;

mapping optical absorption and scattering properties of the object to the first reconstructed image, resulting in mapped optical properties;

detecting internally derived bioluminescent signals emitted from the object using a bioluminescent imaging device, wherein the internally derived bioluminescent signals are not reliant on external energy excitation; and

~~producing~~ reconstructing a bioluminescent source distribution of the object from the internally derived bioluminescent signals based on the mapped optical properties, with a radiative transfer equation or an approximation to the radiative transfer equation.

2. (**Original**) The method of claim 1, wherein the first reconstructed image shows two or three dimensional structural details of the object.

3. (**Previously Presented**) The method of claim 1, wherein the bioluminescent source distribution shows two or three dimensional distribution of light emission from the object.

4. (**Previously Presented**) The method of claim 1, wherein the bioluminescent source distribution is reconstructed to represent multiple types of source distributions with various spectral characteristics.

5. (**Previously Presented**) The method of claim 1, wherein bioluminescent source distribution is reconstructed from a single or multiple angles of view.

6. (**Previously Presented**) The method of claim 1, wherein the bioluminescent source distribution is reconstructed using an iterative or analytic approach.

7. (**Original**) The method of claim 1, wherein the step of detecting optical signals uses sensors.

8. (**Original**) The method of claim 7, wherein the step of detecting optical signals also uses optical path components.

9. (**Previously Presented**) The method of claim 1, wherein the bioluminescent source distribution shows cross-sectional or volumetric views of the object or quantitative features of underlying source distributions of the object.

10. (**Original**) The method of claim 1, wherein the optical properties include at least one of absorption coefficients, scattering coefficients, scattering anisotropy, indices of refraction, and features of underlying sources.

11. (**Previously Presented**) The method of claim 1, wherein the tomographic imaging modality includes at least one of x-ray computed tomography, micro computed tomography, magnetic resonance imaging, and ultrasound.

12. (**Canceled**).

13. (**Original**) The method of claim 1, further comprising segmenting the first reconstructed image into regions, wherein the step of mapping maps the optical properties to each segmented region of the image.

14. (**Previously Presented**) The method of claim 1, further comprising registering the first reconstructed image with the detected optical signals before producing the bioluminescent source distribution.

15. (**Original**) The method of claim 14, wherein the step of registering uses a landmark-based method, a land-mark free method, or an optical surface imager method.

16. (**Currently Amended**) A system for reconstructing a bioluminescent source distribution within an object, comprising:

a tomographic imaging device for imaging the object to produce a first reconstructed image;

a library of optical absorption and scattering properties of the object, based on data measured previously;

a processor for mapping the optical absorption and scattering properties of the object to the first reconstructed image, resulting in mapped optical properties; and

a bioluminescent imaging device comprising one or more imagers sensitive to one or more internally derived bioluminescent sources of spectral characteristics, wherein the internally derived bioluminescent signals are not reliant on external energy excitation, and wherein the bioluminescent imaging device is configured for

detecting internally derived bioluminescent signals emitted from the object using the one or more imagers and

~~producing~~ reconstructing a bioluminescent source distribution of the object based on the mapped optical properties, wherein the bioluminescent source distribution is produced using a radiative transfer equation or an approximation to radiative transfer equation.

17. (**Original**) The system of claim 16, wherein the first reconstructed image shows two or three dimensional structural details of the object.

18. (**Previously Presented**) The system of claim 16, wherein the bioluminescent source distribution shows two or three dimensional distribution of light emission from the object.

19. (**Previously Presented**) The system of claim 16, wherein the bioluminescent source distribution is reconstructed to represent multiple types of source distributions with various spectral characteristics.

20. (**Previously Presented**) The system of claim 16, wherein the bioluminescent source distribution is reconstructed from a single or multiple angles of view.

21. (**Previously Presented**) The system of claim 16, wherein the bioluminescent source distribution is reconstructed using an iterative or analytic approach.

22. (**Previously Presented**) The system of claim 16, wherein the optical imaging device uses sensors for detecting the optical signal emissions.

23. (**Previously Presented**) The system of claim 22, wherein the optical imaging device further comprises optical path components.

24. (**Previously Presented**) The system of claim 16, wherein the bioluminescent source distribution shows cross-sectional or volumetric views or quantitative features of the underlying source distribution(s).

25. (**Original**) The system of claim 16, wherein the optical properties include at least one of absorption coefficients, scattering coefficients, scattering anisotropy, indices of refraction, and features of underlying sources.

26. (**Previously Presented**) The system of claim 16, wherein the tomographic imaging modality includes at least one of x-ray computed tomography scan, micro computed tomography scan, magnetic resonance imaging, and ultrasound.

27. (**Canceled**).

28. (**Original**) The system of claim 16, wherein the processor segments the first reconstructed image into regions and maps the optical properties to each segmented region of the image.

29. (**Previously Presented**) The system of claim 16, wherein the processor registers the first reconstructed image with the detected optical signals before the bioluminescent source distribution is produced.

30. (**Original**) The system of claim 29, wherein the processor performs registration using a landmark-based method, a landmark-free method, or an optical surface imager based method.

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